Near-field Imaging and Manipulation of Light in Photonic Crystals

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We use Scanning Near-field Optical Microscopy to image directly the spatial extent of light in photonic crystal microcavities and waveguides. We show that the analysis of such field maps reveals important information about the deviations of the crystal structure from its nominal fabrication design [1, 2]. Our findings emphasize that the performance of photonic crystal structures is very sensitive to various design parameters and that a very high degree of control is necessary in the fabrication.

In addition to imaging, we discuss how a near-field probe can be used to manipulate the resonance of a photonic crystal microcavity. By performing Finite Difference Time Domain (FDTD) as well as perturbative analytic calculations, we demonstrate that it is possible to shift the resonance of a microcavity while maintaining a high quality factor [3]. We discuss prospects of this technique for opto-mechanical switching of photonic crystals. Furthermore, we will present results on the modification of spontaneous emission of a nanoscopic emitter placed in the near field of a two-dimensional photonic crystal slab [4].

[1] P. Kramper, et al., *Opt. Lett.* **29**, 174 (2004).
[2] B. C. Buchler, et al., *IEICE Trans.Electron.* **E87-C**, 371 (2004).
[3] A. F. Koenderink, M. Kafesaki, B. C. Buchler, V. Sandoghdar, *submitted*.
[4] A. F. Koenderink, et al., *in preparation*.